PB84-154723

Survey of Direct Analysis Methods for Organic Compounds in Particulate Matter

Battelle Columbus Labs., OH

Prepared for

Environmental Monitoring Systems Lab.
Research Triangle Park, NC

Jan 84

U.S. Department of Commerce
National Technical Information Service
NTIS

PB84-154723

EPA-600/4-84-016
January 1984

SURVEY OF DIRECT ANALYSIS METHODS FOR ORGANIC COMPOUNDS IN PARTICULATE MATTER

by

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Contract Number 68-02-3487
Work Assignment Number 8

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U.S. DEPARTMENT OF COMMERCE

TECHNICAL REPORT DATA (Please read Instructions on the reverse before completing)		
1. REPORT NO. EPA-600/4-84-016	2.	3. RECIPIENT'S ACCESSION NO. PB84 154723
4. TITLE AND SUBTITLE "Survey of Direct Analysis Methods for Organic Compounds in Particulate Matter"		5. REPORT DATE January 1984 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) C. A. Alexander, J. R. Hoyland, R. H. Barnes, and J. S. Ogden		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Battelle Columbus Laboratories Columbus, Ohio 43201		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO. 68-02-3487
12. SPONSORING AGENCY NAME AND ADDRESS U. S. Environmental Protection Agency Environmental Monitoring Systems Laboratory Research Triangle Park, N. C. 27711		13. TYPE OF REPORT AND PERIOD COVERED Final Report 1981-1982 14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES		

16. ABSTRACT

Spark source, secondary ion and direct probe mass spectroscopy and infrared, Raman and photoacoustic optical spectroscopy were evaluated for their present and potential usefulness in direct quantification and semiquantitative analysis of aromatic hydrocarbons in particulate matter.

It was found that spark source mass spectroscopy, secondary ion mass spectroscopy, Fourier-Transform infrared and Raman spectroscopy and photoacoustic spectroscopy did not provide sufficient sensitivity for the determination of environmental levels of polycyclic aromatic hydrocarbons in particulate matter. Direct probe thermal desorption mass spectroscopy was found to be capable of the detection and quantification of organic compounds, particularly high molecular weight species not detected by commonly used extraction processes followed by gas chromatography or gas chromatography/ mass spectroscopic analysis. It is further concluded that the organic material absorbed on ambient particulate matter may be much more complex than previously suspected.

17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field Group
18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS (This Report) Unclassified	21. NO. OF PAGES 53
	20. SECURITY CLASS (This page) Unclassified	22. PRICE

EPA Form 2220-1 (9-73)

DISCLAIMER

The information in this document has been funded wholly or in part by the United States Environmental Protection Agency under Contract 68-02-3487 to Battelle Columbus Laboratories. It has been subject to the Agency's peer and administrative review, and it has been approved for publication as an EPA document. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

FOREWORD

Measurement and monitoring research efforts are designed to anticipate potential environmental problems, to support regulatory actions by developing an in-depth understanding of the nature and processes that impact health and the ecology, to provide innovative means of monitoring compliance with regulations, and to evaluate the effectiveness of health and environmental protection efforts through the monitoring of long-term trends. The Environmental Monitoring Systems Laboratory, Research Triangle Park, North Carolina, has responsibility for: assessment of environmental monitoring technology and systems; implementation of agency-wide quality assurance programs for air pollution measurement systems; and supplying technical support to other groups in the Agency including the Office of Air, Noise, and Radiation, the Office of Pesticides and Toxic Substances, and the Office of Solid Waste and Emergency Response.

In support of monitoring studies, analytical methods must be available for analyzing organic air pollutants in both the gas phase and in the airborne solid (particulate) phase. Presently used methods for determining organic compounds in particulate matter require tedious, time-consuming, and expensive procedures involving liquid-solid extraction of the organic compounds from the particulate matter. There are several emerging techniques which may be potentially useful in monitoring organic pollutants in particulate matter without extraction, i.e., by direct methods. This study is concerned with the evaluation of these emerging techniques for the requirements of monitoring applications.

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ABSTRACT

Spark source, secondary ion and direct probe mass spectroscopy and infrared, Raman and photoacoustic optical spectroscopy were evaluated for their present and potential usefulness in direct qualitative and semiquantitative analysis of aromatic hydrocarbons in particulate matter.

It was found that spark source mass spectroscopy, secondary ion mass spectroscopy, Fourier-Transform infrared and Raman spectroscopy and photoacoustic spectroscopy did not provide sufficient sensitivity for the determination of environmental levels of polycyclic aromatic hydrocarbons in particulate matter. Direct probe thermal desorption mass spectroscopy was found to be capable of the detection and quantification of organic compounds, particularly high molecular weight species not detected by commonly used extraction processes followed by gas chromatography or gas chromatography/mass spectroscopic analysis. It is further concluded that the organic material absorbed on ambient particulate matter may be much more complex than previously suspected.

This report was submitted in fulfillment of Contract No. 68-02-3487, Work Assignment No. 8 by Battelle Columbus Laboratories under the sponsorship of the U.S. Environmental Protection Agency. This report covers the period May 1, 1981 through May 30, 1983, and work was completed as of May 1, 1982.

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